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Distribution Pattern and Phytosociological study of Trees Associated with Agroforestry in Poonch District of Jammu and Kashmir, India

DISTRIBUTION PATTERN AND PHYTOSOCIOLOGICAL STUDY OF TREES ASSOCIATED WITH AGROFORESTRY IN POONCH DISTRICT OF JAMMU AND KASHMIR, INDIA

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ABSTRACT

The focus of present study was to find the phytosociology, distribution pattern, and diversity of different species of trees associated with traditional agroforestry in the district of Poonch, Jammu and Kashmir, India. Data was collected through quadrat survey method. A total of fifty quadrats of the size (10x10m) each were thrown randomly in agriculture fields. Total 26 tree species belonging to 16 families and 21 genera were encountered in the agricultural fields with *Grewia optiva*, *Pyrus persica* and *Celtis australis* being the tree species in dominance. The most dense species of tree recorded was *Grewia optiva* with a density value of 3.88 tree/ha which was followed by *Pyrus persica* with a density of 3.74 tree/ha. *Buxus wallichiana* was the least dense species recorded (0.82 tree/ha). The study revealed that the area has vast potential sites for the plantation of various agroforestry related tree species to solve the problems of fuel, fodder and timber.

Keywords: Poonch, agroforestry, phytosociology, distribution, traditional use.

INTRODUCTION

To meet the growing need of human population and livestock, various unsustainable agricultural and allied activities has taken place in the recent past. It has resulted in overexploitation of natural resources. This decline in natural resources has led many environmentalists, agriculturists and animal scientists to find more sustainable food, fodder and fuel production systems. In addition to food as a basic need, fuel wood, timber and fodder have equal importance to meet the needs of growing populations (Kanaujia et al., 2018). Agroforestry offers an alternate solution in this regard. Agroforestry is a collective term which is normally used for different activities including planting trees on farm boundaries, in croplands, on fallow lands and within village settlement etc. (FAO, 2005). Farming communities incorporate different woody perennials in their cropping system along with the animal units depending upon the physiographic and climatic conditions (Pandey, 1998). Depletion of agricultural lands due to changing rainfall pattern, landslide, leaching of nutrients, run off, lack of irrigation facilities and drying up of natural springs have resulted in agricultural activities in the mountain regions which are uneconomical in India in general and Jammu & Kashmir in particular. Most of the villages in mountainous region of Jammu and Kashmir have witnessed mass migration resulting in the production of waste, fallow and unproductive land due to which rural livestock based livelihood has got affected. Agroforestry play an important role in supporting local livelihood and economy by providing various products and services. Trees on farms play an important role in providing food, fodder, fuel wood, medicines, timber, and replenish organic matter, along with controlling erosion and conserving water etc. besides generating

additional income. Tree based fodder also plays an important role in providing traditional farming system which help in reducing the fodder shortage problems in mountainous regions of India especially in the Himalayas during the lean period, when fodder becomes scarce. Agroforestry can be promoted as sustainable practice to combine the best attributes of forestry and agriculture. From an ecological point of view, intercropping and mixed arable-livestock systems can work as sound agroforestry systems and can increase the sustainability of any agricultural production. Poonch is one of the hilly districts of Jammu and Kashmir, India and is rich in biodiversity particularly in floral wealth. Main occupation of the people is agriculture and cattle rearing. Various developmental activities in the area have resulted in the overexploitation of natural resources which has direct impact on agricultural and livestock based livelihood in the region. Keeping this in view a phytosociological analysis was conducted to assess the potential of agroforestry in the region.

MATERIAL AND METHODS

Study Area

The Poonch district of Jammu and Kashmir, India, was chosen for the present study. It lies in the foothills of Pir Panjal range in the Western Himalayas and has an average elevation of 981 meters above sea level. Geographically it is located within 33.770 N latitude and 74.10 E longitudes. Climate of the study area ranges from sub-tropical to temperate with a temperature range of 20-39 ^{o}C in summers and 3-19 ^{o}C in winters. The district has hilly, steep and undulate topography along with plain valleys, which are drained by many small nallahs and rivulets. Three seasons, that is, summer, winter, and rainy are normally observed in the study area. The monsoon rainfall affects the vegetation of the study area. The primary occupation of residents is normally agriculture. Pastoralism is also practised by nomadic groups like Gujjars and Bakerwals. Agriculture system in the area mainly depends on rainfall. The following soil types, that is, loamy soils, sub-mountainous, and alluvial are common in the area.

Methodology

During this study observations were made regarding the current status, distribution pattern and diversity of tree species grown in agricultural fields and other adjoining areas from May to October 2018. To study the tree composition, quadrat survey method was used, a total of fifty quadrats of 10 x 10 m size were thrown randomly throughout the agricultural fields to get the most representative composition of vegetation. The samples were taken at an interval of 5 km. The plants having girth of more than or equal to 30 cm were considered as trees and their circumference at breast height (1.3 meters above the ground) was measured. Data collected was analysed to get frequency, density, abundance and importance value index (IVI) as given below (Curtis, 1951; Misra, 1968).

$$\text{Frequency (F)} = \frac{\text{Number of quadrats in which species occurs}}{\text{Total number of quadrats}} \times 100$$

$$\text{Relative Frequency (RF)} = \frac{\text{Frequency of individual species}}{\text{Frequency of all species}} \times 100$$

$$\text{Density (D)} = \frac{\text{Total number of individuals of the species}}{\text{Total number of quadrats studied}} \times 100$$

$$\text{Relative density (RD)} = \frac{\text{Density of individual species}}{\text{Density for all species}} \times 100$$

$$\text{Abundance} = \frac{\text{Total no. of individual of a species in all quadrats}}{\text{Total no. of quadrats in which species occurred}}$$

$$\text{Relative Abundance (RA)} = \frac{\text{Abundance of individual of a species}}{\text{Abundance of all species}} \times 100$$

$$\text{Importance Value Index} = RF + RD + RA$$

RESULTS AND DISCUSSION

Distribution pattern and species composition of various tree species associated with traditional agroforestry was studied. A total of 26 plant species which were belonging to 16 families and 21 genera were reported from agricultural fields and other adjoining area. Rosaceae was the most dominant family with 07 species followed by Moraceae with 03 Species (Table 1.). The phytosociological analysis revealed that *Grewia optiva* was the most frequent tree species with a frequency of 96 followed by *Pyrus persica* and *Celtis australis*. *Platanus orientalis* was observed as the least frequent tree species with a frequency value of 20. *Salix alba* as the most abundant tree species with a value of 4.07 followed by *Pyrus persica* and *Pyrus pashia* with a value of 4.06 respectively. *Buxus wallichiana* was found to be the least abundant tree species in the area with a value of 2.15.

Table 1: List of common agroforestry tree species found in Poonch district.

S. No.	Species	Family	Common Name	Uses
1	*Acacia nilotica* (L.) Willd.	Fabaceae	Kikar	Fuel, Fodder
2	*Buxus wallichiana* L.	Buxaceae	Chikri	Fuel,Furniture
3	*Celtis australis* L.	Ulmaceae	Khirk	Fuel, Fodder
4	*Dalbergia sisso* Roxb.ex DC	Fabaceae	Tali	Fuel, Furniture
5	*Diospyros lotus* L.	Ebenaceae	Malook	Fuel, Fruits
6	*Ficus hispida* L.	Moraceae	Tossi	Fruits
7	*Ficus palmata* Forssk.	Moraceae	Phagwara	Fruits
8	*Grewia optiva* J.R.Drumm.	Tiliaceae	Thaman	Fodder
9	*Juglans regia* L.	Juglandiaceae	Khor	Fruit, Fuel
10	*Mallotus philippinensis* (Lamk.) Muell.	Euphorbiaceae	Kamila	Fodder
11	*Malus pumila* Mill.	Rosaceae	Seb	Fruits
12	*Melia azedarach* L.	Meliaceae	Dareek	Fuel, Fodder
13	*Morus alba* L.	Moraceae	Toot	Fruit, Fodder
14	*Olea cuspidata* Wall ex DC.	Oleaceae	Kahu	Fodder
15	*Pinus roxburghi* Roxb.	Pinaceae	chir	Fuel, Furniture
16	*Platanus orientalis* L.	Platanaceae	Chinar	Aesthetic, Fodder
17	*Prunus armeniaca* L.	Rosaceae	Khari	Fuel, Fruits
18	*Prunus domestica* L.	Rosaceae	Plump	Fruits
19	*Punica granatum* L.	Punicaceae	Dharuna	Fruits
20	*Prunus persica* (L.) Batsch	Rosaceae	Rawara	Fruits
21	*Pyrus communis* L.	Rosaceae	Nakh	Fruits
22	*Pyrus pashia* Buch-Ham.	Rosaceae	Batangi	Fuel, Fruits
23	*Pyrus persica* Pers.	Rosaceae	Dandali	Fuel, Fruits
24	*Salix alba* Boiss.	Salicaceae	Beesa	Fuel, Fodder
25	*Ulmus wallichiana* Planch.	Ulmaceae	Mannu	Fuel, Fodder
26	*Ziziphus mauritiana* Lamk.	Rhamnaceae	Ber	Fruit, Fodder

The density value for different tree species encountered in the study area ranges between 3.88 to 0.82.The maximum density was revealed by *Grewia optiva* (3.88) followed by *Pyrus persica, Celtis australis* and *Melia azedarach* with a value of 3.74, 3.7 and 3.62 respectively. The minimum density was revealed by *Buxus wallichiana* with a value of 0.82 (Table 2.).

Table 2: Phytosociological attributes of tree species associated with traditional agriculture.

S.No	Species	Frequency	Density	Abundance	A/F
1	*Acacia nilotica* (L.) Willd.	62	1.82	2.93	0.047
2	*Buxus wallichiana* L.	38	0.82	2.15	0.056
3	*Celtis australis* L.	94	3.7	3.93	0.041
4	*Dalbergia sisso* Roxb.ex DC	38	1.12	2.94	0.077
5	*Diospyros lotus* L.	26	0.98	3.76	0.144
6	*Ficus hispida* L.	54	1.56	2.88	0.053
7	*Ficus palmata* Forssk.	82	3.3	4.02	0.049
8	*Grewia optiva* J.R.Drumm.	96	3.88	4.04	0.042
9	*Juglans regia* L.	50	1.52	3.04	0.060
10	*Mallotus philippinensis* (Lamk.) Muell.	42	1.24	2.95	0.070
11	*Malus pumila* Mill.	22	0.84	3.81	0.173
12	*Melia azedarach* L.	90	3.62	4.02	0.04
13	*Morus alba* L.	84	3.4	4.04	0.048
14	*Olea cuspidata* Wall ex DC.	88	3.54	4.02	0.045
15	*Pinus roxburghi* Roxb.	44	1.34	3.04	0.069
16	*Platanus orientalis* L.	20	1.1	5.5	0.275
17	*Prunus armeniaca* L.	88	3.5	3.97	0.045
18	*Prunus domestica* L.	80	2.46	3.07	0.038
19	*Punica granatum* L.	86	3.48	4.04	0.046
20	*Prunus persica* (L.) Batsch	76	2.26	2.97	0.039
21	*Pyrus communis* L.	86	2.56	2.97	0.034
22	*Pyrus pashia* Buch-Ham.	88	3.58	4.06	0.046
23	*Pyrus persica* Pers.	92	3.74	4.06	0.044
24	*Salix alba* Boiss.	72	3.18	4.07	0.056
25	*Ulmus wallichiana* Planch.	78	2.36	3.02	0.038
26	*Ziziphus mauritiana* Lamk.	74	2.18	2.94	0.039

The importance value index for different tree species encountered in the study area was found to vary from 16 to 6.71. IVI value was found maximum (16) for *Grewia optiva* with a relative frequency, relative density and relative abundance of 5.48, 6.15 and 4.37 respectively whereas *Malus pumila* has the least IVI value of 6.71 with 1.25, 1.33 and 4.13 values of relative frequency, relative density and relative abundance respectively. The A/F (Abundance/Frequency) ratio was found to be in the range of 0.275 for *Platanus orientalis* to 0.04 for *Melia azedarach* (Table3.).

The distribution pattern of different tree species in agricultural field and other adjoining areas was found to be random and contagious both. Out of the 26 species reported *Acacia nilotica, Celtis australis, Grewia optiva, Ficus palmata, Melia azedarach, Morus alba, Olea cuspidata, Prunus armenica, Prunus domestica, Punica granatum, Pyrus persica, Ulmus wallichiana* and *Ziziphus mauritiana* show

random distribution whereas the rest show contagious distribution. In similar types of studies conducted in Jammu and Kashmir (Rashid and Sharma, 2012; Kour and Sharma, 2014; Hussain et al., 2014) and other parts of the western Himalayas (Singh and Singh, 2019) both random and contagious distribution was reported. Moreover, contagious distribution was observed as commonest pattern in the nature and is resulted due to the variations in the environment pattern (Odum, 1998)

Table 3: Phytosociological attributes of tree species associated with traditional agriculture.

S.No	Species	Relative Frequency	Relative Density	Relative Abundance	IVI
1	*Acacia nilotica* (L.) Willd.	3.54	2.88	3.17	9.59
2	*Buxus wallichiana* L.	2.17	1.29	2.33	5.79
3	*Celtis australis* L.	5.37	5.86	4.26	15.49
4	*Dalbergia sisso* Roxb.ex DC	2. 17	1.77	3.18	7.12
5	*Diospyros lotus* L.	1.48	1.55	4.07	7.1
6	*Ficus hispida* L.	3.08	2.47	3.12	8.67
7	*Ficus palmata* Forssk.	4.68	5.23	4.36	14.27
8	*Grewia optiva* J.R.Drumm.	5.48	6.15	4.37	16
9	*Juglans regia* L.	2.85	2.40	3.29	8.54
10	*Mallotus philippinensis* (Lamk.) Muell.	2.4	1.96	3.19	7.55
11	*Malus pumila* Mill.	1.25	1.33	4.13	6.71
12	*Melia azedarach* L.	5.14	5.73	4.36	15.23
13	*Morus alba* L.	4.8	5.38	4.38	14.56
14	*Olea cuspidata* Wall ex DC.	5.02	5.61	4.35	14.98
15	*Pinus roxburghi* Roxb.	2.51	2.12	3.29	7.92
16	*Platanus orientalis* L.	1.14	1.74	5.96	8.84
17	*Prunus armeniaca* L.	5.02	5.54	4.30	14.86
18	*Prunus domestica* L.	4.57	3.89	3.32	11.78
19	*Punica granatum* L.	4.91	5.51	4.38	14.8
20	*Prunus persica* (L.) Batsch	4.34	3.58	3.21	11.13
21	*Pyrus communis* L.	4.91	4.05	3.21	12.17
22	*Pyrus pashia* Buch-Ham.	5.02	5.67	4.40	15.09
23	*Pyrus persica* Pers.	5.25	5.92	4.40	15.57
24	*Salix alba* Boiss.	4.11	5.04	4.41	13.56
25	*Ulmus wallichiana* Planch.	4.45	3.74	3.27	11.46
26	*Ziziphus mauritiana* Lamk.	4.22	3.45	3.18	10.85

CONCLUSION

The study revealed that the trees in agricultural fields are sparse. There is wide scope and potential for agro-forestry in the area due to availability of vast agricultural land, fallow lands, wastelands which can be used for the plantation of various agroforestry related trees to solve the problems of fuel, fodder and timber at the local level. Mass awareness among the farmers must be created regarding agroforestry and its benefits by mobilizing local resources.

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